

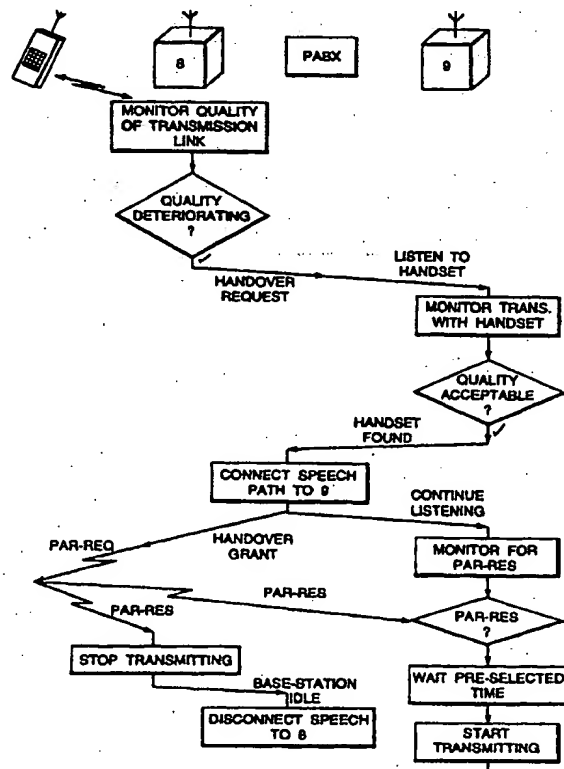
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### (57) Abstract

In a cordless telecommunications system a call carried by a first radio link between a first base-station and a cordless handset may be transferred to one carried by a second radio link between a new base-station which is one of a plurality of frame synchronised base-stations and the cordless handset, the base-stations being connected to a Private Automatic Branch Exchange PABX, by carrying out the steps of: (i) the first base-station monitoring the quality of the first radio link, and upon deterioration of the link-sending a first message to the PABX, (ii) the PABX upon receipt of the first message initiating monitoring of the quality of radio transmissions from the cordless handset by the base-stations, (iii) a new base-station detecting a radio link from the handset whose quality exceeds a predetermined value sending a second message to the PABX, and (iv) the PABX connecting the call from the handset to the new base-station in parallel with the first base-station, and then transferring transmission between the first and second radio links.



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CORDLESS TELECOMMUNICATIONS HANDOVER

The present invention relates to a cordless telecommunications system in particular to cordless telephone apparatus comprising a cordless handset and base-station conforming to the European Telecommunications Standards Institute (ETSI) I-ETS 300 131 R1. This standard, which is incorporated herein by reference, is for radio equipment and systems and provides a common air interface specification to be used for the interworking between cordless telephone apparatus in the frequency band 864.1 MHz to 868.1 MHz, including public access services.

In a cordless telecommunications system a network of base-stations are provided which communicate, by means of a radio link, with the cordless handset. For a given call the base-station, usually the one geographically closest, will communicate with the cordless handset. The strength of the radio link with a given base-station will depend upon the location of the cordless handset which being mobile may change during a call. It is therefore desirable during a call to switch, or handover, the call between base-stations to ensure the radio link with the handset is of an acceptably high standard. It is an object of the present invention to provide a method for handover between a cordless handset and a burst synchronized base-station conforming to I-ETS 300 131 R1 in which neither a change of radio channel nor burst structure is necessary.

Accordingly the present invention provides in a cordless telecommunications system a method of transferring a call carried by a first radio link between a first base-station and a cordless handset, to one carried by a second radio link between a new base-station which

is one of a plurality of frame synchronised base-stations and the cordless handset. the base-stations being connected to a Private Automatic Branch Exchange PABX, comprising the steps of;

- (i) the first base-station monitoring the quality of the first radio link, and upon  
5 deterioration of the link sending a first message to the PABX,
- (ii) the PABX upon receipt of the first message initiating monitoring of the quality of radio transmissions from the cordless handset by the base-stations,
- (iii) upon a new base-station detecting a radio link whose quality exceeds a predetermined value sending a second message to the PABX, and
- 10 (iv) the PABX connecting the call from the handset to the new base-station in parallel with the first base-station, and transferring transmission between the first and second radio links.

Preferably the cordless telecommunications system operates according to I-ETSI 300 131 R1 and the transfer of transmission between the first and second radio links includes  
15 the first base-station transmitting a PAR\_REQ to the cordless handset, in response the cordless handset transmitting a PAR\_RES, the first base-station ceasing transmission and the new base-station transmitting after a pre-selected delay.

A method of performing the invention will now be described by way of example only with reference to the accompanying drawings in which :-

- 20 Figure 1 is a schematic representation of a cordless telecommunications system and
- Figure 2 is a flow chart of the handover method in accordance with the present invention.

Figure 1 shows a schematic representation of a cordless telecommunications system,

which comprises a telecommunications network 1 which is typically a Public Switched Telephone Network (PSTN), although in the future an Integrated Services Digital Network (ISDN) may be more common. The telecommunications network 1 is connected to Private Automatic Branch Exchanges (PABX's) 2 which themselves control a plurality of CT2 base-stations 4 (CT2 - Cordless telephones of the second generation conforming to I-ETS 300 131 R1) of a cordless telephone apparatus. Each PABX 2 is connected to the telecommunications network 1 by a network link, which will typically include some or all of a wired link, an optical fibre link or a long distance radio link.

As shown in Figure 1 the cordless telephone apparatus, to which the present invention relates, comprises a plurality of base-stations 4 and a cordless handset 6. The cordless handset will typically be a telephone handset for speech communication but can also comprise a facsimile machine or other data communicating device. The handset 6 communicates with the base-station 4 over a radio link 7. The base-stations 4 are arranged to provide overlapping radio zones ensuring that a radio link 7 will always be available regardless of the geographic location of the cordless handset 6. In this way a user of the handset 6 has access to any other cordless handset, or conventional telephone 3, connected to the telecommunications network 1.

Although Figure 1 shows a single handset 6 communicating with a given base-station 4, a plurality of handsets could be simultaneously communicating with a single base-station using different radio channels. As the user of the handset moves away from the base-station the strength of the radio link within the zone covered by the base-station will weaken. There will come a point where the radio link would be stronger with the base-station in a neighbouring zone. At this point it is desirable to transfer, or Handover, the

radio link to the new base-station serving this zone to maintain transmission quality.

A method of Handover in accordance with the invention will be described with reference to Figure 2. Figure 2 is a flow chart for the handover operation between a first base-station and a new base-station in a neighbouring zone.

5       The first base-station which has an established call with the handset continuously monitors the quality of the radio link. When the first base-station detects a trend of deteriorating quality in the radio link it requests Handover of the PABX to which it is connected. It does this by sending a first message, or **Handover Request**, to the PABX which message includes the Portable Identification Code (**PID**) or serial number of the  
10   handset, the radio channel currently in operation and the multiplex (**MUX1.2** or **MUX1.4**). All of the terms are defined in I-ETS 300 131 R1.

      The PABX in response to the **Handover Request** sends a message, referred to as a **Listen to Handset**, to base-stations in neighbouring zones initiating the base-stations to monitor the quality of radio transmissions from the handset. The **Listen to Handset** also  
15   includes the same information as the **Handover Request** that in **PID**, radio channel and multiplex. Since the base-stations in the neighbouring zones are frame synchronised they are able to detect and decode transmissions from the handset on the specified radio channel in the appropriate multiplex. If the **PID** contained in the **ID\_OK** matches the **PID** in the  
      **Listen to Handset** the base-station continues monitoring the quality of transmissions from  
20   the handset for a short period, typically five seconds. This new base-station then sends a **Handset Found** message to the PABX if the quality of the transmission link exceeds a pre-selected threshold. The **Handset Found** message contains the **PID** of the handset.

      In response the PABX sends a message to the first base-station to continue listening

and connects the speech, or data, path to the new base-station in parallel with the first base-station. The PABX sends a **Handover Grant** message to the first base-station which transmits a **PAR\_REQ** to the handset. Upon receiving a **PAR\_RES** from the handset the first base-station ceases transmitting to the handset and sends a **Base-Station Idle** message,

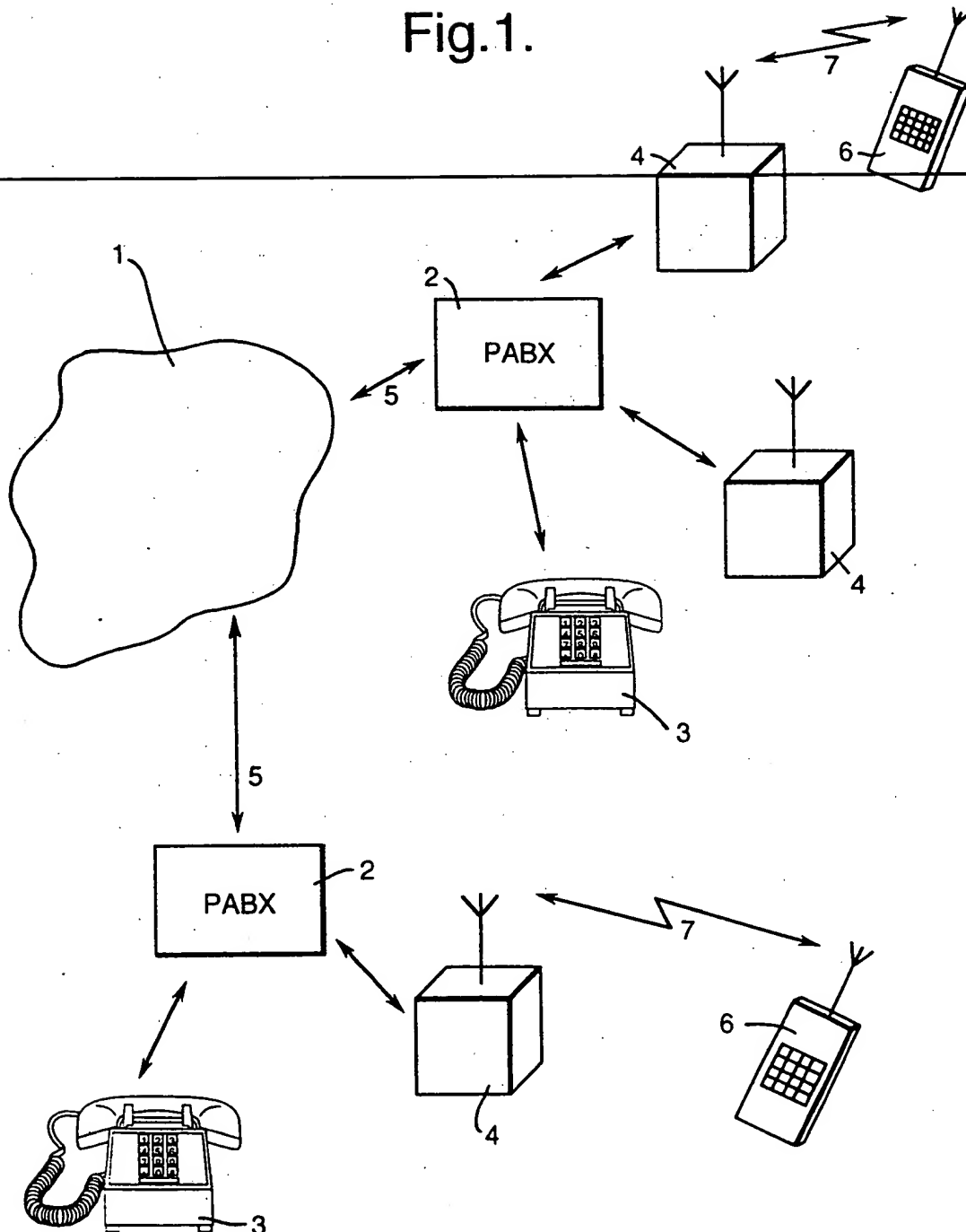
- 5 contain the **PID** to the PABX. The new base-station which is still monitoring transmissions from the handset upon detecting the **PAR\_RES** pauses a pre-selected period, approximately 5mS, before transmitting data from the speech path to the handset thereby completing the handover sequence to the new base-station.

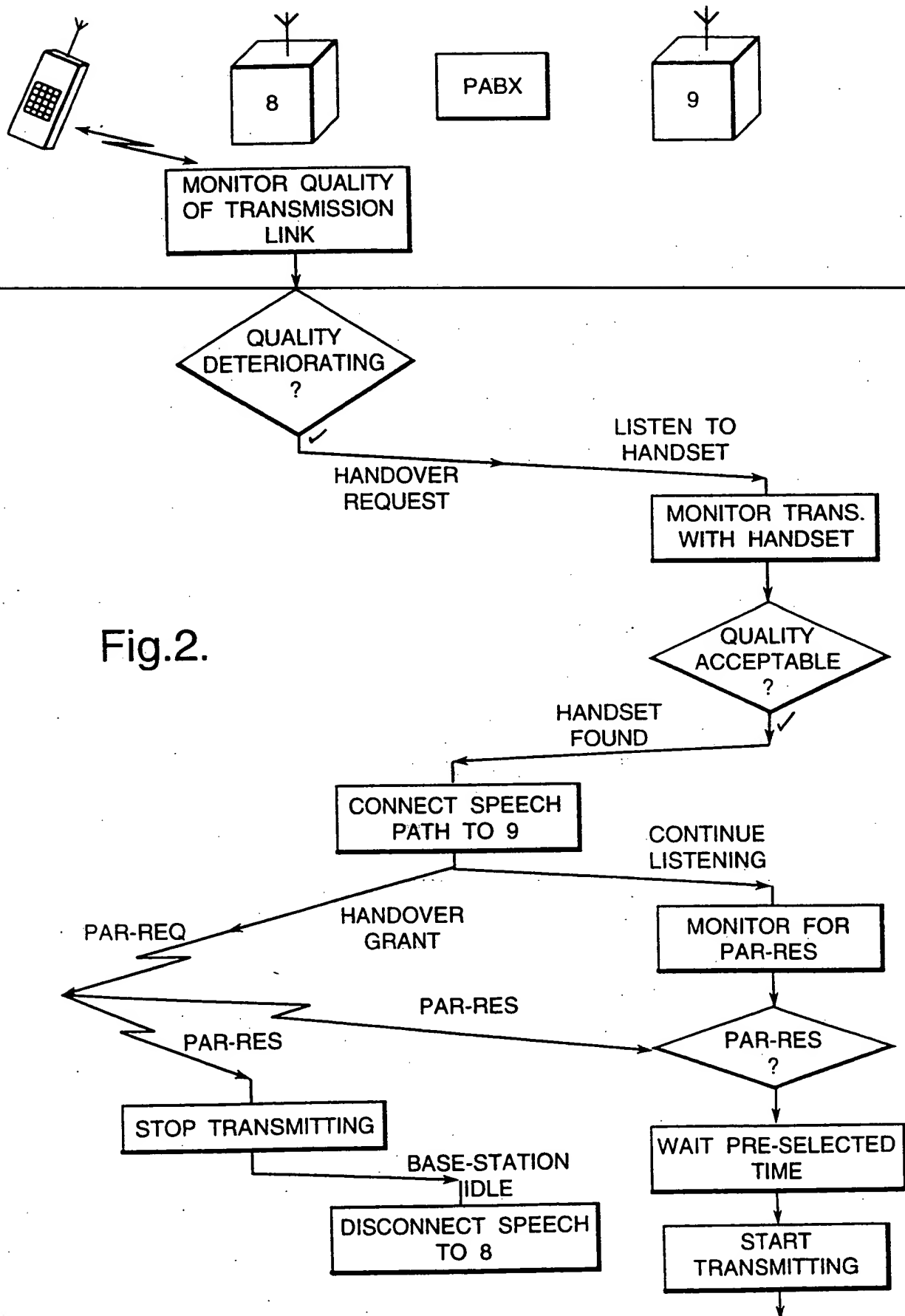
CLAIMS

1. In a cordless telecommunications system a method of transferring a call carried by a first radio link between a first base-station and a cordless handset, to one carried by a second radio link between a new base-station which is one of a plurality of frame  
5 synchronised base-stations and the cordless handset, the base-stations being connected to a Private Automatic Branch Exchange PABX, comprising the steps of;
- (i) the first base-station monitoring the quality of the first radio link, and upon deterioration of the link sending a first message to the PABX,
  - (ii) the PABX upon receipt of the first message initiating monitoring of the quality of  
10 radio transmissions from the cordless handset by the base-stations,
  - (iii) a new base-station detecting a radio link whose quality exceeds a predetermined value sending a second message to the PABX, and
  - (iv) the PABX connecting the call from the handset to the new base-station in parallel with the first base-station, and transferring transmission between the first and second radio  
15 links.
2. A method according to Claim 1 in which the cordless telecommunications system operates according to I-ETSI 300 131 R1 and in which the transfer of transmission between the first and second radio links includes the first base-station transmitting a PAR\_REQ to the cordless handset, in response the cordless handset transmitting a  
20 PAR\_RES, the first base-station ceasing transmission and the new base-station transmitting after a pre-selected delay.



Fig.1.





A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04Q H04M

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,94 05109 (MOTOROLA INC) 3 March 1994 see page 3, line 36 - page 4, line 16 see page 4, line 35 - page 5, line 20 see page 8, line 28 - page 9, line 2 see page 10, line 19 - line 23 see page 11, line 22 - page 12, line 33 see page 14, line 5 - line 36 ---	1
X,P	WO,A,94 19913 (AT & T WIRELESS COMMUNICATIONS ; BEESLEY GRAHAM EDGAR (GB)) 1 September 1994 see page 4, line 11 - line 32 see page 7, line 5 - line 9 see page 10, line 25 - page 11, line 11 see page 12, line 7 - line 15 see page 12, line 23 - line 32 see page 13, line 9 - page 15, line 31 see page 16, line 6 - line 31 --- -/--	1

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